The 3 Dimensions ofCircularity

Recent years have witnessed an explosion of indicators, metrics, assessment tools, and checklists that help identify products and practices that support a Circular Economy. To align with the essence of circularity while employing circular strategies in operations, we suggest thinking of product circularity in the following three dimensions.

As for sustainability, circularity has also many aspects to consider. The three dimensions provide valuable guidance on how to achieve the broad vision of a Circular Economy. In order to capture important aspects of circularity in any business operation, it is advisable to systematically consider these three dimensions.

1) Material recirculation: the degree to which products are composed of material recovered from some prior use (e.g. remanufactured or recycled) rather than composed of primary “virgin” material; and the extent to which materials are designed to be recovered / recycled after use;

2) Utilisation: frequency at which products are used rather than sitting idly (e.g. in storage); and

3) Endurance: the extent to which products retain value over time, rather than becoming physically degraded or socially irrelevant (e.g. physically or socially obsolete).

It may be challenging for all products to maximise all three dimensions, and there is a need to discuss the primary and possible goals for each product group.

It may be tempting to collapse all three dimensions into a single composite circularity score, but since there is no natural relationship between material recirculation, utilisation, and endurance we recommend that these three dimensions are assessed and reported separately, as a dashboard of circularity indicators.

![Figure 1. Three Dimensions of Circularit](image-url)
Measuring Material Recirculation: Metrics can focus on one or multiple recirculation pathways like repair, reuse, remanufacturing, or recycling. Metrics can also focus on either recirculated inputs (e.g. how much of my product is made of reused, refabricated, or recycled stuff), recirculated outputs (how much of my product or my manufacturing waste ends up being recirculated at the end of its functional life), or both. Sustainable Business researchers at RISE Research Institutes of Sweden have developed and tested a metric that focuses specifically on material recirculation. The metric, called “C”, is defined as the proportion of a product’s economic value that comes from recirculated material. Simply expressed, C is equal to the economic value of a product’s recirculated material divided by its total economic value. The outcome is a single value, between 0 and 1, where a score of 1 represents a product whose value comes entirely from recirculated material.

Measuring Utilisation: RISE Sustainable Business researchers are considering metrics for utilisation based on changes in economic value. The “U” metric — still under development — is defined by the proportion of a product’s change in economic value due to being used, rather than changes due to physical decay or exogenous shifts in the marketplace.

Measuring Endurance: RISE Sustainable Business researchers have begun to develop a Market Entropy (ME) metric that is determined by estimating the cost of restoring a product to its original market value. It is expressed as one minus a ratio of:

a) the total cost of the utility of a product (i.e. the cost of maintaining, repairing, refurbishing a product and delivering a product’s utility) in some random period of time; to

b) the total value of the utility of a product, measured in sales revenue.

In short, a product that is low-cost to maintain at its market value is rewarded with a higher, better score. Such a metric encourages long-lasting, high-quality products that are inexpensive to repair. It also encourages future-adaptive design of products, so that products can in fact improve with time. Designers can enhance a product’s endurance through future adaptive design, which would allow for relatively inexpensive repair, upgrades, and modification that keeps a product relevant.

Read More

More information about this research and circular economy metrics can be found on the RISE webpage. This research was financed by the Marianne and Marcus Wallenberg Foundation. It was conducted by the Sustainable Business Unit at RISE Research Institutes of Sweden (RISE).

RISE Sustainable Business undertakes actionable research for the transition to a circular economy. In-depth knowledge areas include business model innovation, business financing, future-adaptive product design, and key performance metrics.